National Climatic Data Center

DATA DOCUMENTATION

FOR

DATA SET 3720 (DSI-3720)

USSR Monthly Precipitation for 622 Stations 1891-1999

March 24, 2003

National Climatic Data Center
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1. Abstract: This is the latest version of the precipitation data set for the former USSR. The archive contains mean monthly precipitation data for the period 1891-1999 for 622 stations of the former Soviet Union and a set of metadata files that is essential for the use of these data in climate change studies. The file "history.doc" and this "read me" file are in Word 7.0. Other data and metadata files are in ASCII.

We are continuously improving our data set and are extremely grateful when users report errors and/or suspicious values. We shall promptly address the questionable data in the users' report in the future.

For those who worked with our previous version of this archive (with data up to 1993) below you will find differences between the past and present versions of the archive:

1. An obvious change is that the data are now available up to 1999.

2. More than 4,500 infilled monthly values for the period of 1984 to 1993 were introduced in the present version.

3. After quality control and intercomparison with other data sources, approximately 2300 monthly precipitation values (most of them in the 1979-1984 period) have been corrected.

4. Four stations (Malye Karmakuly, Karpinsk, Petropavlovsk-Kamchatskiy Mayak, and Petropavlovsk-Kamchatskiy City) received corrected WMO numbers, and the two latter stations had a minor adjustment (update) of their coordinates and elevation.

5. For the stations that do not have instrument change correction coefficients (K1), the cold season monthly precipitation values were replaced with a missing code for the period prior to the introduction of the current rain gauge (Tretiyakov shielded gauge that was installed throughout the network in the early 1950s). This uneasy decision was made to prevent the misuse of the data of incomparable instruments by users who do not read and/or ignore the warnings in our lengthy archive description.

6. A re-adjusted version of the archive (that better accounts for various wetting biases of the rain gauge throughout the period of observations) is provided together with the "original" time series. This readjustment is small and will be important only for those users who intend study climate changes using this archive.

Archive history

The archive of monthly precipitation sums on the USSR territory is based on "The calendar of monthly precipitation anomalies in percents of the normal by the data from the stations on the USSR territory" for 1891 -1984 created in VNIIGMI WDC /1,2,3/.

Initially, the archive contained data from 594 stations. Another 28 stations and gauge posts located in the grain belt of the country and in central regions of European Russia were later added to the archive in the State Hydrological Institute.

The archive includes observational data for 1891 from 152 stations in the European part of the USSR and from only 53 stations in the Asian part, while

by 1940 the number of stations increased to 276 and 302, respectively, and changed insignificantly after that until 1990. By 1970 the archive contained the data from 585 stations. As of 1990, only about 50 (of 622) stations and gauge posts included in the archive either stopped operating or, for several different reasons, it was decided that further use of the data from these stations was no longer inexpedient.

The initial archive /1,2,3/ had the peculiarity that the data were presented in the form of percents of various normals. These normals were the mean values for two basic periods - 1891-1940 (Nipher rain gauge normal N1) and 1941-1960 (Tretiyakov gauge normal N2). Taking into account that Tretiyakov gauges replaced Nipher shielded rain gauges over the entire meteorological network by the middle 1950s, compilers of the archive introduced the third rain gauge normal N3 for the period 1941 to the beginning of Tretiyakov gauge observations. For this purpose, a scale coefficient K1, which reduces the Nipher rain gauge measurements to Tretiyakov gauge measurements /4/, was used. Thus, N3 = N2/K1. When the homogeneity of the time series was broken, in some cases precipitation normals were calculated separately for the periods before and after the homogeneity breaks. This technique was proposed in the Main Geophysical Observatory, St. Petersburg, Russia (MGO) and was used there for the production of the "Atlas of Monthly Precipitation in Percents of the Normal."

Particular mention should go to the preparation of the data for the period after 1966. Since January 1, 1966, precipitation started being measured four times a day instead of two times at all the USSR stations, except those in the 7-9 time zones (East Siberia) and at the precipitation gauge posts (i.e., at the secondary precipitation network). These two times per day observations were introduced in 1936 in place of the one per day observational schedule. At the same time (since 1966), all precipitation measurements started being corrected for wetting losses from the gauge bucket. Wetting loss (that is, moisture on the walls of the gauge bucket) was estimated in field experiments for solid and liquid precipitation separately, and these values were then added to each measured precipitation value /5, 8, 9/. The correction value usually was equal to 5-15% of the measured precipitation amount. Thus, the homogeneity of most of the observational time series was broken twice. The amount of moisture retained on the walls of the gauge bucket became different due to the transition to 4 times per day measurements, and the precipitation time series homogeneity became broken, even without the introduction of a wetting correction. More thorough analysis /10/ shows that when the number of measurements is changed, the increased wetting of the gauge bucket is partly compensated for by the decreased evaporation between the measurements. The situation was complicated by the fact that introduced corrections at first were not published in the reference books. Since 1966 corrections started to be introduced but were not published. It was only during the following years that all the offices began publishing these corrections in the form of a separate table or column in Meteorological Monthlies but then discontinued this practice.

On January 1, 1986 it was decided to return to two per day precipitation measurements everywhere, except the stations of the third time zone (West-European part of the USSR). The compilers of the archive /1, 2, 3/ excluded, when it was possible, the wetting correction from their data. As a result, they did not take into account that due to the transition to 4 times per day measurements the wetting of the gauge bucket had changed. Thus, initial archives /1, 2, 3/ for 1966-1984 included time series with broken homogeneity, which was rather difficult to correct. Also, since 1979 most of the data was

taken by the authors /3/ from communication channels ("Climate" cables). This information is less reliable when compared with the data from Meteorological Monthlies.

A task was set in the State Hydrological Institute to restore the homogeneity of precipitation time series /1, 2, 3/, accepting the now existing procedure of the measurements as a standard one. Since 1985 the archive was compiled in SHI, using precipitation data given in Meteorological Monthlies and (since 1989) "Climate" cables. The wetting correction is not excluded from these data. Therefore, the change of the number of precipitation measurements per day, introduced in 1986, influenced somewhat the homogeneity of the time series.

The archive /1, 2, 3/ was transformed in the State Hydrological Institute in order to secure quasi-homogeneous (from the point of view of observation method) precipitation time series for the entire observational period for liquid precipitation and for solid precipitation - for the period beginning with the introduction of the Nipher shield at the station to the present. The following transformations were performed on the data of the /1, 2, 3/ archive:

- The measured monthly precipitation values were restored (instead of percents of different normals).
- The measurements of rain gauges with a Nipher shield were reduced to the measurements of the Tretiyakov gauge with the help of K1 coefficients. Such reduction introduces into the observational data a random scale error with mathematical expectation equal to 1.
- The change in observation routine (wetting correction introduced in 1966) was taken into account as follows:

A constant mean monthly correction K3 / 4 / for the wetting of the gauge bucket, calculated for each station, was added to the data for 1967-1984 [i.e., Pn = P*(1+K3)], where P is the observed precipitation without wetting correction; half of the value of this correction K3/2 was added to the data for 1891-1935 and a whole value of this correction was added to the data for 1936-1965. The data for 1966 remained unchanged. The data for this year overestimate the precipitation in the cold season due to confusion in the USSR network, which occurred in 1966 by introducing an inaccurate wetting correction. This confusion was fixed only in 1967 (see also / 8 /). The number of measurements per day was not increased in 1966 at the precipitation gauge posts (i.e., at the secondary precipitation network). It remained the same - two times per day. The archive includes 19 such posts and 122 stations in the 7-9 times zones.

The work with the archive / 1 / was started in the SHI in 1977. In the same year Pavel Ya. Groisman compiled an Appendix to the archive containing information on the changes in the environs of meteorological ground and shifts of locations of stations, which were sure to break the homogeneity of the precipitation time series. This information was compiled based on the analysis of station passports and "The history and physical-geographic description of stations and gauge posts," which was published as a part of "Reference book on the climate of the USSR" /4/.

It was assumed that the homogeneity of the precipitation time series was broken:

a) when a station in a mountainous region shifted,
b) when a station is moved so that its elevation changed significantly (>50 m),
c) if there was anything that prevented the device from working correctly (blowing of snow from a roof into the gauge bucket, incorrect setting of the device, etc.).

There are a small number of such stations in the archive. Also, in the cold season the homogeneity of monthly precipitation time series was considered to be broken if the degree of protection of the device from the wind was changed as a result of moving the station or changing its surroundings. Thus, about one third of the precipitation time series were considered inhomogeneous during the winter season. The date of installing the Nipher shield on the gauge was determined for each station. Data on solid precipitation for the period preceding that date were also considered inhomogeneous compared with the data in the following period.

In 1989, Groisman and Koknaeva repeated this investigation, having supplemented information about changes in the 622-station network that have taken place over the past 30 years. Since that time we were not able to update our station history files, except for essential information about the station closure.

Below we describe the way in which the wetting correction is inserted into the observation data since January 1, 1967:

a) if precipitation occurred between the measurements but not a single drop ran out of the gauge bucket, a correction was not made;
b) if precipitation was equal to 0.0, i.e., less than 0.5 scale division of the measuring sleeve but at least a single drop ran out of the bucket, a correction equal to 0.1 mm was made for liquid and mixed precipitation, while for solid precipitation no correction was made;
c) if precipitation was > 0.1 mm (i.e., more than 0.5 scale division of the measuring sleeve), a correction equal to 0.2 mm for liquid and mixed precipitation and 0.1 mm for solid precipitation was made.

During 1966 the wetting corrections applied at each station were greater for solid precipitation. There was no differentiation between solid precipitation and liquid and mixed precipitation in items (b) and (c) of the present method of the wetting correction. These corrections turned out to be too large, and it was decided not to apply them. However, initial data for 1966 had already been changed and were published in the reference books. Thus, the data for winter precipitation for 1966 are overestimated.

2. **Element Names and Definitions**:

The archive is composed of several files.

The main file ("file4upd99.dat") consists of monthly precipitation from 622 stations for 1891-1999 ordered according to the numbers in the list of stations (file "STATION.LST"). File “STATION.LST” contains the station numbers (from 1 to 622) coordinates (up to hundredth of degree), elevations (in meters), WMO numbers, and names. Few stations (from the secondary precipitation network, or posts) do not have WMO numbers and their positions are filled with 99999.

The record format of recording in the main file is (1X, I3, 1X, I4, 1X, 12F5.1), where the first number is the station number, the second is the year, followed by 12 monthly precipitation totals. Each of the 622 stations has 109 lines in this file. The code for missing data is –1.0.

We preserved the original data sources from the previous version of the archive (which ends in 1993) but made a concerted effort to update the last 15 years from all possible sources. These sources are described in the order of preference used for the archive update.

1. "Meteorological Monthlies" originally were the major source for update during the period from 1985 to 1988. Later they were used, when it was possible, for updating the previous archive version up to 1993.

2. For the period from 1989 to 1993 the data were obtained more frequently from the "Climate" cables sent to VNIIGMI-WDC (Obninsk) and then from "Meteorological Monthlies," because these publications became infrequent and often unavailable from different parts of the former USSR (fUSSR). A specific feature of the "Climate" cables is the rounding of the monthly precipitation totals to whole mm. Whenever it was possible, we use the "Monthlies".

The data from these sources were already incorporated into the previous version of the archive; only some infilling of missing sources was performed for the period prior to 1993. From data source 3 we infilled 4055 monthly values, and from data source 4 we infilled 398 monthly values for the 1985-1993 period, most of them (83%) for the 1990s. In 2000, two additional sources of the fUSSR precipitation data (# 3 and #4 described below) became available at the National Climatic Data Center via the bilateral collaboration with the World Data Center B, WDC-B, for Meteorology (Obninsk, Russia) and the data rescue efforts of the WDC-B and the Institute for Global Climate and Ecology (Moscow, Russia).

3. Reliable daily precipitation data measured and recorded by the national weather services of the Commonwealth of Independent States and Baltic States and then rescued (digitized and quality controlled) by the WDC-B were used to update the archive for the period from 1994 to 1996 and to infill missing values during the previous years (since 1984).

4. The Institute for Global Climate and Ecology (Moscow, Russia) has compiled its own archive of monthly precipitation for the period up to 1998 / 11 / with a significant overlap of our stations. The single data source for this archive since the 1980s were the "Climate" cables. These data were the single source for us in updating our archive for the period from 1997 to 1998 and to infill missing values during the previous years (totally 6080 monthly values were taken from this archive for the 1994-1996 period).

5. The complete set of national Russian "Climate" cables for 1999 (including many of those from CIS and the Baltic States) was provided to us by Dr. Vyacheslav N. Razuvaev. These data were the major single source for us in updating our archive for 1999.

6. After all Russian-based sources of information were exhausted, we tapped the international source of the Global Telecommunication System accumulated in NCDC in the framework of the Global Historical Climatology Network. This source provided us 573 additional monthly precipitation

values for the period of 1991 to 1999 that were not available in the Russian archives (mostly from the fUSSR countries other than Russia, 64 of them in year 1999).

7. Due to the nature of changes in the data (re-adjustments for wetting correction described below, see also /9/) which we introduced in the file "file4upd99_adj.dat," we could not easily update the original archive data prior to 1985 because of conversions in the original data source "The calendar of monthly precipitation anomalies in percents of the normal by the data from the stations of the USSR territory" for 1891 –1984 /1, 2, 3/. In the last months of 1984 there were too many missing values in the original archive due to the late report practice. Therefore, we considered it inappropriate to leave these missing values in our archive, and a special provision was made for this year: we extracted all currently available (but originally missing) monthly values from the 3rd and 4th sources of the update (totally 595 monthly values or 8% of the entire data volume for this year; 589 of which were from the 3rd data source) and specially processed them when composing our wetting re-adjusted file "file4upd99_adj.dat."

File "file4upd99_adj.dat" contains the wetting re-adjusted file of the same data based on the analysis presented in /9/. These are relatively small corrections (a few percent), but their systematic nature noticeably changes the century-long precipitation trends over the former Soviet Union /9/. Table 1 provides the adjustments used for each time zone, type of station, and period of time. The methodology that leads to these adjustments is described in Appendix 1 of /9/. The format of this file is the same as for "file4upd99.dat." If we were to have the daily and sub-daily precipitation amount and type information for each station in our archive, these re-adjustments would be individual and "better." However, we did not have easy access to this information and had to settle for those shown below and based on a subset (about a quarter) of our station archive.

Table 1. Scale corrections (in percent) which were used to change the mean monthly precipitation values in our archive from "file4upd99.dat" to "file4upd99_adj.dat" using the formula: $P_{adjsted} = P_{original}$ (1+0.01[scale correction]). "Cold" season is defined as October through March and the "warm" season as April through September. Some of time zones (Third to Sixth) are divided into two latitudinal parts by 55 N.

Time interval					Season	Region
pre-1936	1936 to 1965	1966 to 1984	1985 after Stations	1986 after Posts		
0.8	-1.8	-0.3	-3.4	-0.8	Cold	North of time zone 3
0.8	-1.8	-0.8	-2.5	-0.5	Cold	South of time zone 3
-0.5	-3.4	-2.1	-4.8	-1.9	Cold	North of time zones 4-6
0.2	-2.8	-2.0	-2.5	-0.7	Cold	South of time zones 4-6
-0.6	-5.0	-5.0	-2.2	-2.2	Cold	time zones 7-9
0.3	-4.0	-2.0	-4.9	-1.8	Cold	time zones 10 through 13
0.6	-1.5	-0.5	-1.3	0.0	Warm	North of time zone 3
1.2	-0.8	0.0	-0.9	0.0	Warm	South of time zone 3
0.5	-2.0	-0.8	-1.5	0.0	Warm	North of time zones 4-6
0.6	-2.2	-1.4	-0.9	0.0	Warm	South of time zones 4-6

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0.6	-2.1	-1.7	0.0	0.0	0.0	Warm	time zones 7-9
0.4	-2.0	-0.2	-2.0	-0.1	-0.1	Warm	time zones 10-13

Files of correction coefficients (K1, K2, K3) to the precipitation normals from the data of "The Reference book on Climate of the USSR" /4/ are located in three metadata files, "K1.LST," "K2N.LST," and "K3.LST".

For each station, file "K1.LST" contains a line of information [format (I3,1X,i4,1X,i2,2X,12F5.2)] with the station number, the date (year and month) of the installation of the new Tretiyakov rain gauge in place of the previous Nipher-shielded gauge, and 12 coefficients of transition for the normal obtained from the data of the Nipher shielded rain gauge to the normal obtained from the data of Tretiyakov gauge for every month (K1). This coefficient is equal to 1 during the months with liquid precipitation, and, as a rule, >1 during the months with solid and mixed precipitation. In some southern regions of the USSR (Middle Asia, Moldavia) this coefficient is identically equal to 1 because regional meteorological services did not find any significant systematic changes while passing to the application of the new device. The code for missing data is 9.99 for K1 values and 9999 and 99 for year and month of the gauge type change (when it has never happened).

For each station, file "K2N.LST" contains a line of information [format (I3, I5, I3, 2X, A2, 2X,12(1x,F4.2))] with the station number, the year and the month when the Nipher shielded rain gauge replaced the Tretiyakov gauge, the type of station protection according to the classification by Shver / 4, 5 /, and 12 coefficients - multipliers K2 of wind correction to the normals measured with the Tretiyakov gauge. The code for missing data is - 9 in all significant positions. File "K2.LST" is identical to "K2N.LST" but the types of station protection are skipped in this file [format (I3, I5, I3, 2X, 12(1x,F4.2))].

For each station, file "K3.LST" contains a line of information [format (I3, 14X, 12F5.2)] with the station number and 12 coefficients K3, characterizing the share of mean monthly precipitation which remains in the gauge bucket after it has been emptied (the so-called corrections for wetting). This file contains all K3 coefficients without gaps.

The file of coordinates and commentaries, "HISTORY.doc," was not changed since the previous version (except essential corrections of the WMO numbers for four stations mentioned earlier and minimal adjustments in coordinates and elevations for two of them, #566 and #567). This is now a Microsoft Word 7.0 file instead of the previously used WordPerfect 5.1 format. For user convenience an ASCII version of this file, "HISTORY.asc," is also provided. The description below of this file was not changed from the previous version of the archive. This file is a listing divided by the headings into parts consisting of 20-40 lines, each part for 9 stations. The heading is divided into three columns by the symbol "*" and look like this:

Reg # Lat. Long. H (m) * Station * Nipher	The dates of changes in the position of the station or in its environs

The first column of the listing includes the station number, its latitude, longitude, and elevation (in meters) in the format (5X, I3, 1X, F5.2, 1X, F6.2, 1X, F4.0). The second line of this column presents the synoptic index of the station in the format (I5,21X).

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The second column, which is 21 symbols wide, contains the name, of the station in Russian characters in the first line and in English in the second line. The last column contains information about the shifts of the station, changes in its openness to wind and other information characterizing the homogeneity of precipitation time series, and the quality of the data from the station. This information is divided into 4 groups.

The initial 11 positions, of the first line of column 4 contain information on the date of Nipher shield establishment at the gauge if it is known that for a certain period of time precipitation was measured without this shield. Otherwise these positions are blank. As a rule, the presence of a gap means that from the very beginning the measurements were made using a Nipher-shielded rain gauge. The format of this information is (3X, I4, I2, 2X), where the first number is year and the second is the month when the Nipher shield was established. If the month is unknown, two blanks are in its position.

The next N*8 positions of the column (the second group of information) contain the information about the dates of station relocations and (or) other changes in the surroundings of the meteorological site (N is the number of these changes). The format of recording of these positions is (A1, I3, I2, A1, 1X). If the first symbol of the recording is "*", it means that shifts did not occur any longer and the following symbols belong to another group. It the first symbol is "1", it means that following further are the characteristics of the shift (change) – the number of the year (-1000), the month of the shift and symbols " " ", " > " or " < ". Symbol " > " means that after the shift the wind protection of the gauge has improved and more precipitation gets into the gauge bucket (mainly in winter). Symbol " < " means that protection has become worse.
Symbol " " means that the information on the change of protection is absent or the degree of protection has not changed. Two blanks in the month position mean that the month of the shift is not known.

Example: First several lines of file “HISTORY.doc”.

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REG.  #   LAT.  LONG. H(M)       STATION           NIPHER   THE DATES OF THE CHANGES IN STATION'S POSITION OR ENVIRONS

      1 61.23  46.63   57* KOTïAC              *          193204  195700  196907  197101  198206 * ok * In Airport
22887                      Kotlas               (from 1932). The greatest moving of site in 1969 (4km). Homogeneity does
                                                not change in the movings (by the opinion of local meteorologists).*
      2 61.40  46.32   50* öEäOTOBO Çασά.ú..í□.*        * ok * Post  (not station), closed in May 1948. The data were
99999                      Fedotovo Arkhan.area based on Nipher shielded gauge measurements.*
      3 61.50  38.93  124* KAPâOÂOï¸          *   1898    191310  * ok *
22845                      Kargopol
      4 62.10  42.90   47* □EHKôPCK           *   1900    1919    1920    1925  > 197001  * ok * After the shift in 1925
22768                      Shenkursk            the growing trees around the station have protected it from the wind
                                                more perfectly but the station always was situated in enough protected
                                                site*
      5 62.17  49.08   71* ˜PEHCK             *   1899    1888    1898    1923    1926    1938    1969    * ok *
22798                      Yarensk              In 1969 the shift was 2.2 km. In archive there are the data only
                                                after 1941.*
      6 63.90  38.12   11* OHEâA              *   1912    1897    1900    1926    *5-10* The shift in 1926 changed the
22641                      Onega                openness to the wind of the meteorological site.*
      7 64.22  41.67   10* XOïMOâOP□          *   1900    189603< 189610> 1919    192005  193606< 195107  * ok * In
22559                      Kholmogory           1919 the Nipher shield was absent, in May 1920 it was established again.
                                                The data in the cold period are homogeneous only for 1900-1936 period.
                                                The data for 1941-1984 were not included in archive. In the summer 1896 &
                                                after 1936 the station has been placed on the open to wind sites.*
      8 64.58  40.50    3* APXAHâEï¸CK         *          1912  > 1935    1943  > 196311  196502  197806  *5- 9* The
22550                      Arkhangelsk          merging of two stations (1965). From the point of
                                                view of Ts.A.Shver the station for the period 1897-1964 had homogeneous
                                                time series, but at the same time the station was situated near the
                                                plant and was not representative for the region. Regional
                                                meteorological office marked the interruption of homogeneity of
                                                precipitation measurements on the station in 1978 not connected with
                                                shifts. *
      9 64.70  43.40   26* ÅêHEâA             *   1909    1891    1909    1913    1914    1920    1926    1937  <
22563                      Pinega               1961    *5-10* In 1988 the station  is transformed into the post. The
                                                main shift influencing the openness of the station was in 1920.
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In the station passport (in 1943) the unrepresentativeness of station site for environs was marked.*

The third group of information (four positions) contains a recommended season for which precipitation data obtained at the station can be considered homogeneous during the entire observational period after the installation of the Nipher shield. If shifts/changes, which entail the changes in the degree of wind protection have occurred, then this is a period of liquid precipitation. The format of recording is (I1,'-', I2), where the numbers before and after the hyphen mean the first and the last month of the season. If shifts were absent or there are no reasons to think that they significantly influenced the homogeneity of a time series, the four positions contain' ok '. If shifts (for example, in a mountainous region) affected the homogeneity noticeably, four positions contain ' bad'. The reasons for such characteristics of the station are given in the commentary. The fourth group of information -- commentaries -- is placed between two symbols " * ".

File "VALDAI" contains the precipitation data from the Valdai experimental meteorological site for 1961(6)-1988(0). Presented are the data from two gauges:

(1) - #98 - measuring "real" precipitation, without taking into account wind or similar noise (the description of wind protection of this device is given in the work by V.S.Golubev /6/;

(2) - standard measurements at Valdai station with individual wetting correction; and

(3) the data from this station contained in file "file4upd99.dat." The combined analysis of these time series allows one to get an idea of the underestimation of precipitation sums by the standard Tretiyakov gauge, as well as of the inaccuracy of data for 1966 due to an incorrect method of making correction for moistening. Each of the three time series has an information line in format (a80) and annual data for 1961(6)-1980(8) in the format (I4, 2X, 12F5.1,F6.1), where the year, 12 monthly sums and annual sum occupy one line. The code for missing data is 999.9 for monthly precipitation and 9999.9 for annual precipitation.

3. Start Date: 1891

4. Stop Date: 1999

5. Coverage: the former USSR

6. How to Order Data:

Ask NCDC's Climate Services about the cost of obtaining this data set.
Phone: 828-271-4800
FAX: 828-271-4876
E-mail: **NCDC.Orders@noaa.gov**

7. Archiving Data Center:

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, NC 28801-5001

Phone: (828) 271-4800.

8. Technical Contact:

National Climatic Data Center (Pavel Groisman)
Federal Building
151 Patton Avenue
Asheville, NC 28801-5001
Phone: (828) 271-4800.

9. Known Uncorrected Problems: If a station stopped operating prior to 1955 and K1 coefficients were not known, K1 was assumed to be identically equal to 1. Besides, the compilers of "The Reference Book on the Climate of the USSR" considered it impossible to calculate K1 coefficients for the Arctic and some coastal stations for the winter period, as well as for time series uniting the data from two or more stations with different degrees of protection against wind. Thus, the scale of changes of moisture conditions at these stations differs from that of neighboring stations. In our archive, the number of such stations is 63. In this archive version we eliminated all cold season precipitation measurements at these 63 stations prior to introduction of the new gauge.

Restoring the homogeneity of precipitation time series for the USSR Arctic regions during the period of solid precipitation became very difficult due to the introduction of a new device in the middle 1950s and the change of measurement method in 1966 and 1967 /7/. Generally, the data obtained by gauge network measurements in the Arctic during the cold season are a complex function of precipitation amount and type, wind field and degree of protection of gauge site. The values of this function can differ from real precipitation values (estimated by different methods) by 100% or more. Work is currently under way at the Main Geophysical Observatory (St. Petersburg, Russia) to develop a comprehensive adjustment routine for the Russian Arctic precipitation measurements. After completion of this work, our archive for the Arctic stations will be updated (re-adjusted) using the results of this work.

The quality of observational data on solid precipitation during the period from the beginning of observations until the establishment of the Nipher windshield (in the beginning of the observational period, and in some rare cases up to World War I) is not known and the homogeneity of time series cannot be restored.

The errors of numerous transformations of initial precipitation sums (in percents of the normals, excluding the wetting correction and its introduction back into the data) resulted in random scale (w1) and position (w2) errors in the data. Though it can be assumed that mathematical expectation Ew1 = 1 and Ew2 = 0, additional noise entailed by these transformations is a part of a significant noise component which is present in all the precipitation time series. However, the comparison of the archive data with that published in the Meteorological Monthlies data up to 1965 shows that the above-mentioned errors w1 and w2 are not large for this period (from 1 to 5% of the total), and the archive can be used for scientific purposes.

Generally speaking, the processing of the archive data for 1966-1984, when wetting corrections were excluded and then introduced again, can be considered neither perfect nor logical. In the future we plan to restore the initial

information for this period with individual wetting corrections made in the data (i.e., to insert the actual measured data when they are available).

10. Quality Statement: See above.

11. Essential Companion Datasets: None.

12. References: The appropriate references for this archive are listed below. Publications 8 and 9 are included in the data set to facilitate use of the archive. They are in PDF format and thus can be read on most computer platforms. Carefully read this description of the archive and the pre-processing procedures, and do not discard any of the metadata files. If these details are not properly understood and/or interpreted, your results may be spurious.

Monthly precipitation in percentage of normals / Ed. A.I. Neushkin. M.: Gidrometeoizdat. M.O. 1975-1977, vyp. 1-3.

Calendar of monthly precipitation anomalies in percentage of normals for the USSR stations over the 1971-1976 period / Ed.T.A. Belokrylova. M.: Gidrometeoizdat. M.O., 1981. 118 p.

Calendar of monthly precipitation anomalies in percentage of normals for the USSR stations over the 1977-1984 period. / Ed. A.I.Neushkin. Obninsk, 1987. 123 p.

Reference book on USSR climate. Vyp. 1-34, Part 4, Section 2. L.: Gidrometeoizdat, 1966-1969.

Shver Ts.A. *Precipitation over the USSR territory*. L.: Gidrometeoizdat, 1976. 302 p.

Golubev V.S. Research on precipitation measurement accuracy. *Proc. State Hydrological Institute*, 1969, **176**, p.149-164.

Bryazgin N.N. The studies of regularities of the Arctic precipitation distribution and the methods of taking into account the errors of precipitation measurements. Doctor Thesis. Leningrad,1972.

Groisman, P.Ya., Koknaeva, V.V., Belokrylova, T.A., and Karl, T.R.: 1991. "Overcoming biases of precipitation measurement: A history of the USSR experience", *Bull. Amer. Meteorol.Soc*, **72**, No.11, 1725-1733.

Groisman, P.Ya. and E. Ya. Rankova, 2001. "Precipitation trends over the Russian permafrost-free zone: removing the artifacts of pre-processing", *Internat. J. Climatol.* (in press).

Bogdanova, E.G. and A.V. Mestcherskaya. Influence of moistening losses on the homogeneity of annual precipitation time series, *Russian Meteorol. Hydrol.*, 1998, No.11, 88-99.

Gruza, G.V., Rankova, E.Ya., Razuvaev, V.N. and Bulygina, O.A. Indicators of climatic change for the Russian Federation, *Climatic Change*, 1999, **42**, 219-242.